Claims

1. A method for the manufacture of an article having a first surface region and a second surface region of different coefficients of friction using a treatment chamber suitable for the carrying out of a PVD process preferably with a rotary support for the article or a plurality of such articles characterized in that at least two PVD coating processes are carried out in the treatment chamber at the same time, with the first PVD coating process being carried out with a comparatively directed vapor flux from one target or from a plurality of targets which can compose one or more of the elements B, Si, Ti, V, Cr, Zr, Nb, Mo, Hf, Ta and W, carbides of the said elements and carbon, and the second PVD coating process being carried out with a comparatively less directed or non-directed vapor flux of carbon.

2. A method in accordance with claim 1 characterized in that the two PVD coating processes are performed by using a single PVD coating apparatus such that a metal vapor or metal and carbide ions are generated with one or more targets using a cathode sputtering process or an arc discharge vaporization process and are directed to the article as a directed vapor flux, with the cathode sputtering process or the arc discharge vaporization process resulting in or contributing to the generation of a plasma in the treatment chamber and hereby to the generation from a hydrocarbon atmosphere present in the treatment chamber of carbon ions and molecules in the form of a less directed or non-directed vapor flux which are at

least partially incorporated into the coating being formed on the article.

3. A method in accordance with claim 2 characterized in that magnetic fields, in particular the magnetic fields associated with an imbalanced magnetron, are used to generate an expanded plasma supplying carbon ions and molecules to the article.

4. A method in accordance with claim 1 characterized in that the two PVD coating processes are carried out in the treatment chamber using a first PVD coating apparatus and a second PVD coating apparatus.

5. A method in accordance with claim 4 characterized in that the article or a plurality of articles is arranged on a rotary support and is moved through the comparatively directed vapor flux of the first PVD coating apparatus by a rotary movement of the support, with said rotary movement being either a simple rotary movement so that the article or each article has a given, at least substantially constant, effective orientation with respect to the said vapor flux, or a complex rotary movement, for example a rotary movement in which the article or each article is rotated around its own axis, with the individual rotary movements being synchronized in the case of a more complex rotary movement such that the article or each article has a given, at least substantially constant, effective orientation with respect to the said vapor flux.

6. A method in accordance with claim 4, characterized in that the first PVD coating apparatus generating a comparatively directed vapor flux is one or more of the following coating apparatuses:
   - an arc discharge vaporization device;
   - a cathode sputtering device, for example in the form of a magnetron or an imbalanced magnetron;
   - a linear ion source, in particular a source of this kind for the generation of carbon ions such as a plasma generating source with a heating filament.

7. A method in accordance with claim 1 characterized in that the second PVD coating apparatus generating a comparatively less directed or non-directed vapor flux is one or more of the following coating apparatuses:
   - an ion source, in particular for the generation of carbon ions from a gaseous hydrocarbon supplied to the treatment chamber;
   - a plasma source, for example with a plasma generated from a microwave source, in particular a high-power microwave source.

8. A method in accordance claim 1 characterized in that a homogeneous layer is formed on the first surface region and consists of a carbide of one or more of the said elements and carbon with a relatively low carbon component, whereby a relatively high coefficient of friction is achieved, and in that a homogeneous layer is formed on the second surface region and consists of a carbide of one or more of the said elements and carbon with a relatively high carbon component, whereby a relatively low coefficient of friction is achieved.

9. A method in accordance with claim 1 characterized in that when boron is used, the coating of the first surface region contains at least substantially approximately 80 at% boron and the remainder consists of 20 at% of carbon and incorporated hydrogen as well as any contaminants, whereas the second surface region has a coating of approximately 55 at% boron and the remainder consists of 45 at% of carbon and incorporated hydrogen as well as any contaminants.

10. A method in accordance with claim 1characterized in that when tungsten is used, the coating of the first surface region contains at least substantially approximately 50 at% tungsten and the remainder consists of 50 at% of carbon and incorporated hydrogen as well as any contaminants, whereas the second surface region has a coating of approximately 15 at% tungsten and the remainder consists of 85 at% of carbon and incorporated hydrogen as well as any contaminants.

11. A method in accordance with claim 1characterized in that a bonding layer of, for example, Cr or Ti is formed on the said surface regions of the article or of each article prior to the generation of the respective coatings.

12. A method in accordance with claim 11 characterized in that the thickness of the bonding layer on the first surface is in the region of 0.1 μm to 1 μm and on the second surface in the region of 0.1 μm to 1 μm.

13. A method in accordance with claim 1 characterized in that the thickness of the coating on the two surface regions, including any bonding layer, is in total between 0.5 μm and 5 μm.

14. A method for the manufacture of an article having a first surface region and a second surface region of different coefficients of friction using a treatment chamber suitable for the carrying out of PVD processes and having a rotary support for the article or a plurality of such articles characterized in that at least a first PVD coating apparatus and a second PVD coating apparatus are used in the treatment chamber, in that the article or plurality of articles is arranged on the rotary support, in that the or each article is furthermore rotatable around its own axis on the rotary support and in that the rotary movement around the or each article's own axis and the rotary movement around the axis of rotation of the support are synchronized such that the first surface region is coated preferably by the first coating apparatus and the second surface region preferably by the second coating apparatus.

15. A method in accordance with claim 14 characterized in that the first PVD coating apparatus and the second PVD coating apparatus are apparatuses which each generate a comparatively directed vapor flux.

16. A method in accordance with claim 14 characterized in that the first PVD coating apparatus and/or the second PVD coating apparatus is one of the following apparatuses:

- an arc discharge vaporization device;

- a cathode sputtering device, for example in the form of a magnetron or an imbalanced magnetron;
- a linear ion source, in particular a source of this kind for the generation of carbon ions such as a plasma generating source with a heating filament.

17. A method in accordance with claim 14 characterized in that a homogeneous layer is formed on the first surface region and consists of a carbide of one or more of the said elements and carbon with a relatively low carbon component, whereby a relatively high coefficient of friction is achieved; and in that a homogeneous layer is formed on the second surface region and consists of a carbide of one or more of the said elements and carbon with a relatively high carbon component, whereby a relatively low coefficient of friction is achieved.

18. A method in accordance with claim 14 characterized in that when boron is used, the coating of the first surface region contains at least substantially approximately 80 at% boron and the remainder consists of 20 at% of carbon and incorporated hydrogen as well as any contaminants, whereas the second surface region has a coating of approximately 55 at% boron and the remainder consists of 45 at% of carbon and incorporated hydrogen as well as any contaminants.

19. A method in accordance with claim 14 characterized in that when tungsten is used, the coating of the first surface region contains at least substantially approximately 50 at% tungsten and the remainder consists of 50 at% of carbon and incorporated hydrogen

as well as any contaminants, whereas the second surface region has a coating of approximately 15 at% tungsten and the remainder consists of 85 at% of carbon and incorporated hydrogen as well as any contaminants.

20. A method in accordance with claim 14 characterized in that a bonding layer of, for example, Cr or Ti is formed on the said surface regions of the article or of each article prior to the generation of the respective coatings.

21. A method in accordance with claim 20 characterized in that the thickness of the bonding layer on the first surface is in the region of 0.1 μm to 1 μm and on the second surface in the region of 0.1 μm to 1 μm.

22. A method in accordance with claim 14 characterized in that the thickness of the coating on the first surface region, including any bonding layer, is in total between 1 μm and 5 μm and in that the thickness of the coating on the second surface region, including any bonding layer, is in total between 1 μm and 5 μm.

23. A method in accordance with claim 14 characterized in that a homogeneous layer is formed on the first surface region and consists of a carbide of one or more of the said elements and carbon with a relatively low carbon component, whereby a relatively high coefficient of friction is achieved, and in that the rotary movements of the or each article around its own axis are synchronized with the rotary movement of the support around its axis of rotation such that a multi-layer structure is created on the second surface region

which comprises alternate thin layers of a carbide of one or more of the said elements and carbon, with the carbon of said alternating layers being generated by the sputtering of a target made of graphite, and in that the process is carried out such that the layer thickness of each carbon layer of the layer sequence is in the region between approximately 1 nm and approximately 20 nm, preferably between 2 and 4 nm, with the topmost layer of the layer sequence preferably consisting of carbon and advantageously being somewhat thicker than the other layers, for example 500 nm, with the layer thickness of the carbide layers being in the region between 1 and 3 nm, and is preferably approximately 2 nm, and in that the carbon of the carbon layer has predominantly sp_3 bonds.

24. An article having a first and a second surface region, characterized in that a homogeneous layer is formed on the first surface region and consists of a carbide of one or more of the said elements and carbon with a relatively low carbon component, whereby a relatively high coefficient of friction is achieved, and in that a homogeneous layer is formed on the second surface region and consists of a carbide of one or more of the said elements ~~and carbon~~ with a relatively high carbon component, whereby a relatively low coefficient ~~of friction~~ is achieved.

25. An article in accordance with claim 24 characterized in that when boron is used, the coating of the first surface region contains at least substantially approximately 80 at% boron and the remainder consists of 20 at% of carbon and incorporated hydrogen as well as any contaminants, whereas the second surface region has a coating of approximately 55 at% boron and the remainder consists of 45

at% of carbon and incorporated hydrogen as well as any contaminants.

26. An article in accordance with claim 24 characterized in that when tungsten is used, the coating of the first surface region contains at least substantially approximately 50 at% tungsten and the remainder consists of 50 at% of carbon and incorporated hydrogen as well as any contaminants, whereas the second surface region has a coating of approximately 15 at% tungsten and the remainder consists of 85 at% of carbon and incorporated hydrogen as well as any contaminants.

27. An article in accordance with claim 24 characterized in that a bonding layer of, for example, Cr or Ti is formed on the said surface regions of the article or of each article prior to the generation of the respective coatings.

28. An article in accordance with claim 27 characterized in that the thickness of the bonding layer on the first surface is in the region of 0.1 μm to 1 μm and on the second surface in the region of 0.1 μm to 1 μm.

29. An article method in accordance with claim 24 characterized in that the thickness of the coating on the first surface region, including any bonding layer, is in total between 1 μm and 5 μm and in that the thickness of the coating on the second surface region, including any bonding layer, is in total between 1 μm and 5 μm.

30. An article in accordance with claim 24 characterized in that a multi-layer structure is formed on the second surface region and

comprises alternate thin layers of a carbide of one or more of the said elements and carbon, with the carbon layers being made from a carbide of at least one element in the form of a metal and/or silicon and/or boron, in that the layer thickness of each carbon layer of the layer sequence is in the region between approximately 1 nm and approximately 20 nm, preferably between 2 and 4 nm, with the topmost layer of the layer sequence preferably consisting of carbon and advantageously being capable of being somewhat thicker than the other layers, for example 500 nm, in that the layer thickness of the carbide layers is in the region between 1 and 3 nm, and is preferably approximately 2 nm, and in that the carbon of the carbon layer has predominantly sp_3 bonds.